

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

1. (currently amended) A method for programming non-volatile memory, comprising:

categorizing particular non-volatile storage elements in a set of non-volatile storage elements into three or more different groups, each particular non-volatile storage element being categorized into one of the different groups based on its the detected behavior of particular non-volatile storage elements in said set of non-volatile storage elements; and

programming said particular non-volatile storage elements using a different programming condition for each of the different groups group.

2. (currently amended) The method according to claim 1, wherein:
said step of programming includes applying different bit line voltages for the different groups.

3. (currently amended) The method according to claim 1, wherein:
said step of programming includes applying a program signal-voltage to said particular non-volatile storage elements via a common word line and applying different bit line voltages for the different groups.

4. (currently amended) The method according to claim 1, wherein:
said step of categorizing includes determining relative programming speeds speed ~~information~~ of said particular non-volatile storage elements ~~relative to each other~~, each of the different groups group including particular non-volatile storage elements with similar relative programming speeds speed information.

5. (currently amended) The method according to claim 1, wherein:

said step of categorizing includes determining programmability of said particular non-volatile storage elements relative to each other, each of the different groups ~~group~~ including particular non-volatile storage elements with similar programmability.

6. (currently amended) The method according to claim 1, wherein:

said step of categorizing includes applying one or more non-zero source voltages to said ~~set of~~ particular non-volatile storage elements and, while applying said one or more non-zero source voltages, characterizing threshold voltages of said ~~set of~~ particular non-volatile storage elements by applying one or more positive voltages to control gates for said particular non-volatile storage elements and determining whether said particular non-volatile storage elements turn-on in order to determine whether said particular non-volatile storage elements have a threshold voltage greater than a negative voltage compare point.

7. (currently amended) The method according to claim 1, wherein:

said step of categorizing includes charging bit lines for said set of non-volatile storage elements, applying a control gate ~~signal~~ voltage and allowing said bit lines to discharge; and

said step of programming ~~said particular non-volatile storage elements using a different programming condition for each group~~ includes adjusting a subset of bit line voltages based on how said bit lines discharged.

8. (currently amended) The method according to claim ~~1~~ 7, further comprising:

applying initial programming to said particular non-volatile storage elements prior to said step of programming ~~said non-volatile storage elements using a different programming condition~~, said step of categorizing is based on said step of applying initial programming.

9. (currently amended) The method according to claim 8, wherein:
said step of applying initial programming and said step of programming ~~said non-volatile storage elements using a different programming condition~~ are performed using a common program signal voltage.

10. (currently amended) The method according to claim 9, wherein:
said common program signal voltage is applied via a common word line; and
said step of adjusting includes determining which of said particular non-volatile storage elements are slow to program, determining which of said particular non-volatile storage elements are fast to program and raising a voltage on bit lines for said particular non-volatile storage elements that are determined to be fast to program.

11. (previously presented) The method according to claim 8, wherein:
said step of applying initial programming is performed until at least one particular non-volatile storage element reaches a target threshold value; and
said step of categorizing is performed for particular non-volatile storage elements that did not yet reach said target threshold value.

12. (currently amended) The method according to claim 1, wherein:
said particular non-volatile storage elements are multi-state storage elements.

13. (currently amended) The method according to claim 1, wherein:
said particular non-volatile storage elements are multi-state NAND flash memory elements.

14. (currently amended) A system for programming non-volatile memory, comprising:
a set of non-volatile storage elements;
a set of control lines in communication with said set of non-volatile storage elements; and

a controlling circuit in communication with said control lines, said controlling circuit causes a categorizing of particular non-volatile storage elements in said set of non-volatile storage elements into three or more different groups based on a detected behavior of particular non-volatile storage elements, each particular ~~in said set of non-volatile storage elements~~ element being categorized into one of the different groups based on its detected behavior, and causes programming of each of said particular non-volatile storage elements using a different programming condition for each of the different groups ~~group~~.

15. (currently amended) The system according to claim 14, wherein:
said control lines includes a set of bit lines and a common word line;
said controlling circuit causes application of a program signal voltage on said common word line; and
said ~~different program programming~~ condition for each ~~group~~ pertains to different bit line voltages.

16. (currently amended) The system according to claim 14, wherein:
said categorizing includes determining relative programming speeds ~~speed information~~ of said particular non-volatile storage elements ~~relative to each other, each group~~ each of the different groups including particular non-volatile storage elements with similar relative programming speeds ~~speed information~~.

17. (currently amended) The system according to claim 14, wherein:
said categorizing includes determining programmability of said particular non-volatile storage elements relative to each other, ~~each group~~ each of the different groups including particular non-volatile storage elements with similar programmability ~~speed information~~.

18. (currently amended) The system according to claim 14, wherein:
said categorizing includes applying a non-zero source voltage to said particular ~~set of~~ non-volatile storage elements and, while applying said non-zero source voltage, characterizing threshold voltages of said particular ~~set of~~ non-volatile storage elements by applying one or more

positive voltages to control gates for said particular non-volatile storage elements and determining whether said particular non-volatile storage elements turn-on in order to determine whether said particular non-volatile storage elements have a threshold voltage greater than a compare point.

19. (currently amended) The system according to claim 14, wherein:

said categorizing includes charging bit lines for said particular ~~set of~~ non-volatile storage elements, applying a common control gate ~~signal~~ voltage and allowing said bit lines to discharge; and

said programming ~~of said non-volatile storage elements using a different programming condition for each group~~ includes adjusting a subset of bit line voltages based on how said bit lines discharged.

20. (currently amended) The system according to claim 14, wherein:

said controller circuit causes initial programming to said particular non-volatile storage elements prior to said programming said particular non-volatile storage elements using a different programming condition, said categorizing is based on said initial programming.

21. (currently amended) The system according to claim 20, wherein:

said initial programming is performed until at least one of said particular non-volatile storage element reaches a target threshold value; and

said categorizing is performed for particular non-volatile storage elements that did not yet reach said target threshold value.

22. (currently amended) The system according to claim 20, wherein:

said initial programming is performed using a common word line ~~signal~~ voltage.

23. (currently amended) The system according to claim 14, wherein:

said particular non-volatile storage elements are multi-state storage elements.

24. (currently amended) The system according to claim 14, wherein:
said particular non-volatile storage elements are multi-state NAND flash memory elements.

25. (currently amended) A method for programming non-volatile memory, comprising:
applying initial programming to non-volatile storage elements until at least one non-volatile storage element reaches a target threshold value; and
subsequently, adjusting programming of at least a subset of non-volatile storage elements that have not reached said target threshold value based on behavior of said non-volatile storage elements that have not reached said target threshold value.

26. (previously presented) The method according to claim 25, further comprising:
characterizing said non-volatile storage elements that have not reached said target threshold value based on programmability, said step of adjusting is based on said step of characterizing.

27. (previously presented) The method according to claim 26, wherein:
said step of characterizing includes comparing a predetermined threshold voltage to threshold voltages for said non-volatile storage elements that have not reached said target threshold value.

28. (previously presented) The method according to claim 27, wherein:
said step of adjusting includes raising bit line voltages for non-volatile storage elements that have threshold voltages greater than said predetermined threshold voltage.

29. (currently amended) The method according to claim 25, wherein further comprising:

said step of applying initial programming to non-volatile storage elements includes applying a common program voltage ~~signal~~ to said non-volatile storage elements, said common program voltage ~~signal~~ increases at a first rate; and

said step of adjusting includes increasing a rate of increase of said common program voltage ~~signal~~ above said first rate.

30. (currently amended) The method according to claim 25, wherein further comprising:

said step of applying initial programming to non-volatile storage elements and said step of adjusting include applying a common program voltage ~~signal~~ to said non-volatile storage elements.

31. (currently amended) The method according to claim 25, wherein further comprising:

said step of applying initial programming to non-volatile storage elements and said step of adjusting include applying a common program voltage ~~signal~~ to control gates of said non-volatile storage elements.

32. (previously presented) The method according to claim 25, wherein:

said step of adjusting includes applying a non-zero source voltage to at least a subset of said non-volatile storage elements and comparing threshold voltages of said subset of non-volatile storage elements to a predetermined positive control gate value while applying said non-zero source voltage in order to determine programmability of said subset of non-volatile storage elements.

33. (currently amended) The method according to claim 25, wherein:

said step of adjusting includes charging bit lines for at least a subset of said non-volatile storage elements, applying a control gate ~~signal~~ voltage to said subset of said non-volatile storage elements and allowing said bit lines to discharge; and

said step of adjusting further includes adjusting a subset of said bit line voltages for programming based on how said bit lines discharged.

34. (previously presented) The method according to claim 25, wherein:
said non-volatile storage elements are multi-state storage elements.

35. (previously presented) The method according to claim 25, wherein:
said non-volatile storage elements are multi-state NAND flash memory elements.

36. (currently amended) A system for programming non-volatile memory,
comprising:
a set of non-volatile storage elements;
control lines in communication with said set of non-volatile storage elements; and
a controlling circuit in communication with said control lines, said controlling circuit
causes initial programming of said non-volatile storage elements until at least one non-volatile
storage element reaches a target threshold value, and, subsequently, said controlling circuit
causes adjustment of programming of at least a subset of non-volatile storage elements that have
not reached said target threshold value based on behavior of said non-volatile storage elements
that have not reached said target threshold value.

37. (previously presented) The system according to claim 36, wherein:
said controlling circuit causes characterization of non-volatile storage elements that have
not reached said target threshold value based on programmability, said adjustment of
programming is based on said characterization.

38. (previously presented) The system according to claim 37, wherein:
said characterization includes comparing a predetermined threshold voltage to threshold
voltages for said non-volatile storage elements that have not reached said target threshold, said
predetermined threshold voltage is lower than said target threshold value.

39. (previously presented) The system according to claim 38, wherein:
said adjustment of programming includes raising bit line voltages for non-volatile storage elements that have threshold voltages greater than said predetermined threshold voltage.

40. (currently amended) The system according to claim 36, wherein:
said initial programming includes applying a common program voltage ~~signal~~ to said non-volatile storage elements, said common program voltage ~~signal~~ increases at a first rate; and
said adjustment of programming includes increasing a rate of increase of said common program voltage ~~signal~~ above said first rate.

41. (currently amended) The system according to claim 36, wherein:
said initial programming includes applying a common program voltage ~~signal~~ to said non-volatile storage elements.

42. (previously presented) The system according to claim 36, wherein:
said adjustment of programming includes applying a non-zero source voltage to at least a subset of said non-volatile storage elements and comparing threshold voltages of said subset of non-volatile storage elements to a predetermined positive control gate value while applying said non-zero source voltage in order to determine programmability of said subset of non-volatile storage elements.

43. (currently amended) The system according to claim 36, wherein:
said adjustment of programming includes charging bit lines for at least a subset of said non-volatile storage elements, applying a control gate ~~signal~~ voltage to said subset of said non-volatile storage elements and allowing said bit lines to discharge; and
said adjustment of programming further includes adjusting a subset of said bit line voltages for programming based on how said bit lines discharged.

44. (previously presented) The system according to claim 36, wherein:
said non-volatile storage elements are multi-state storage elements.

45. (previously presented) The system according to claim 36, wherein:
said non-volatile storage elements are multi-state NAND flash memory elements.

46. (currently amended) A method for programming non-volatile memory,
comprising:
applying an initial program ~~signal~~ voltage to a set of non-volatile storage elements;
applying one or more non-zero source voltages to said set of non-volatile storage
elements after commencing said initial program ~~signal~~ voltage;

while applying said one or more non-zero source voltages, characterizing threshold
voltages of said set of non-volatile storage elements by applying one or more positive voltages to
control gates for said non-volatile storage elements and determining whether said non-volatile
storage elements turn-on in order to determine whether said non-volatile storage elements have a
threshold voltage greater than a compare point; and

adjusting a programming parameter of at least a subset of said non-volatile storage
elements based on said step of characterizing.

47. (previously presented) The method according claim 46, wherein:
said compare point is a negative voltage.

48. (currently amended) The method according to claim 46, wherein:
said initial program ~~signal~~ voltage is applied via a common word line; and
said adjusting said programming parameter includes raising a voltage on one or more bit
lines for said non-volatile storage elements.

49. (currently amended) A system for programming non-volatile memory,
comprising:
a set of non-volatile storage elements;
control lines in communication with said set of non-volatile storage elements; and

a controlling circuit in communication with said control lines, said controlling circuit causes:

application of an initial program signal voltage to said set of non-volatile storage elements,

while applying one or more non-zero source voltages, characterization of threshold voltages of said set of non-volatile storage elements by applying a voltage to control gates for said non-volatile storage elements and determining whether said non-volatile storage elements turn-on in order to determine whether said non-volatile storage elements have a threshold voltage greater than a compare point; and

adjustment of control line voltages of at least a subset of said non-volatile storage elements based on said step of characterizing.

50. (currently amended) The system according to claim 49, wherein:
said control lines includes a set of bit lines and a common word line;
said initial program signal voltage is applied via said common word line; and
said adjustment of said control line voltages includes raising one or more bit line voltages.

51. (currently amended) A method for programming non-volatile memory, comprising:
applying an initial program signal voltage to a non-volatile storage element;
applying a verify signal voltage to a control gate for said of non-volatile storage element after commencing said applying of said initial program signal voltage;
charging a bit line for said of non-volatile storage element after commencing said applying of said initial program signal voltage;
allowing said bit line to discharge; and
adjusting a programming parameter of said non-volatile storage elements based on said bit line discharging.

52. (currently amended) The method according to claim 51, wherein:

said initial program ~~signal~~ voltage is applied via a common word line; and
said adjusting of said programming parameter includes raising a bit line voltage for said non-volatile storage element for subsequent programming.

53. (previously presented) The method according to claim 51, wherein:
said non-volatile storage element is a flash memory device.

54. (currently amended) A system for programming non-volatile memory,
comprising:
a set of non-volatile storage elements;
a word line in communication with said set of non-volatile storage elements;
a set of bit lines in communication with said set of non-volatile storage elements; and
a controlling circuit in communication with said word line, said control lines, and said non-volatile storage elements, said controlling circuit causes:

application of an initial program ~~signal~~ voltage to said non-volatile storage elements,
application of a verify ~~signal~~ voltage at a word line for said of non-volatile storage elements after commencing said initial program ~~signal~~ voltage,
charging of bit lines for said of non-volatile storage elements after commencing said initial program ~~signal~~ voltage,
allowing of said bit lines to discharge,
adjustment of a programming parameter of at least a subset of said non-volatile storage elements based on said bit line discharging, and
completion of programming of said non-volatile storage elements using said adjusted programming parameter.

55. (currently amended) The system according to claim 54, wherein:
said initial program ~~signal~~ voltage is applied via said word line, said word line is common to all said non-volatile storage elements; and

said adjustment of said programming parameter includes raising one or more of said bit lines.

56. (previously presented) The system according to claim 54, wherein:
said program parameter is adjusted differently for different non-volatile storage elements.

57. (previously presented) The system according to claim 54, wherein:
said non-volatile storage elements are flash memory devices.